

WETLAND MONITORING YEAR 1

KEESLER AFB MS



Aug 2001

**WETLAND MONITORING
YEAR 1**

KEESLER AFB MS

Permit

MSNW97-02035-V, Keesler AFB
(Nation Wide Permit (NWP) #38)
Mobile District, Regulatory Branch, Army Corps of Engineers

Waiver

DMR-M-9705590-W
Executive Director, Mississippi Department of Marine Resources

Prepared for
81 CES/CE
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Keesler AFB MS 39534-2115

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Aug 2001

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INTRODUCTION

Purpose

It is the intent of this document to meet the requirements in accordance with Nation Wide Permit (NWP) #38 (reference: MSNW97-02035-V, Keesler AFB) issued by the Mobile District, Regulatory Branch, Army Corps of Engineers and a waiver (reference: DMR-M-9705590-W) issued by the Executive Director of the Mississippi Department of Marine Resources.

Background Summary

A fill area formerly known as "Archery Range" (Figure 1) was restored to a smooth cordgrass/black rush (SPAALT/JUNROE) tidal marsh IAW the above-mentioned permit. The area was delineated which resulted in approximately 21,900 square feet, of that 1/2 acre was excavated to an average depth of twelve inches at high tide.

After excavation, the area was planted in October 1999 with 5,000 sets *Spartina alterniflora* (smooth cordgrass) and 15,000 sets *Juncus roemerianus* (black rush) (Table 1). The plant material was supplied by Horticultural Systems, FL under controlled conditions to best match the Back Bay marsh. (Photo #)

TABLE 1 - SPECIES LIST (PLANTING)

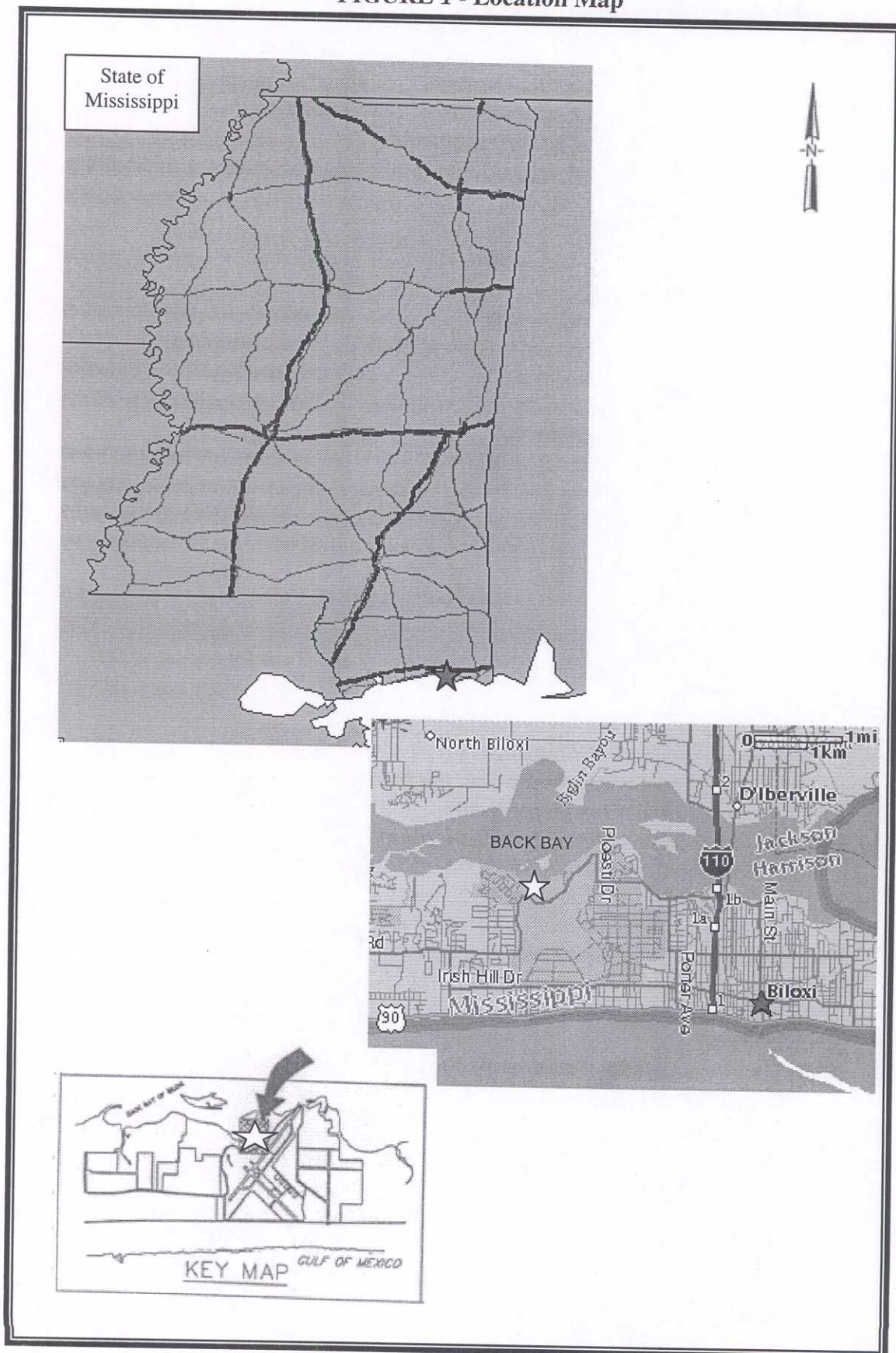
Common Name	Scientific Name	CODE	# planted
Black Rush	<i>Juncus roemerianus</i>	JUNROE	15,000
Smooth cordgrass	<i>Spartina alterniflora</i>	SPAALT	5,000

In September 2000, the Air Force Center for Environmental Excellence (AFCEE) Botanist was asked to assess the wetland. It was determined that 25-30% of the SPAALT and JUNROE did not survive the first year and those were mostly found in areas deeper than 12 inches at high tide. At this meeting it was decided to:

- ✓ replant in Oct-Nov 2000 timeframe,
- ✓ replace the lost plant material with on-site JUNROE,
- ✓ expand the wetland area by removing a small berm (Figure 2),
- ✓ move that soil out into the deeper areas and form hummocks where the surface would be less than 12" deep at high tide, and
- ✓ replant the hummocks with on-site JUNROE.

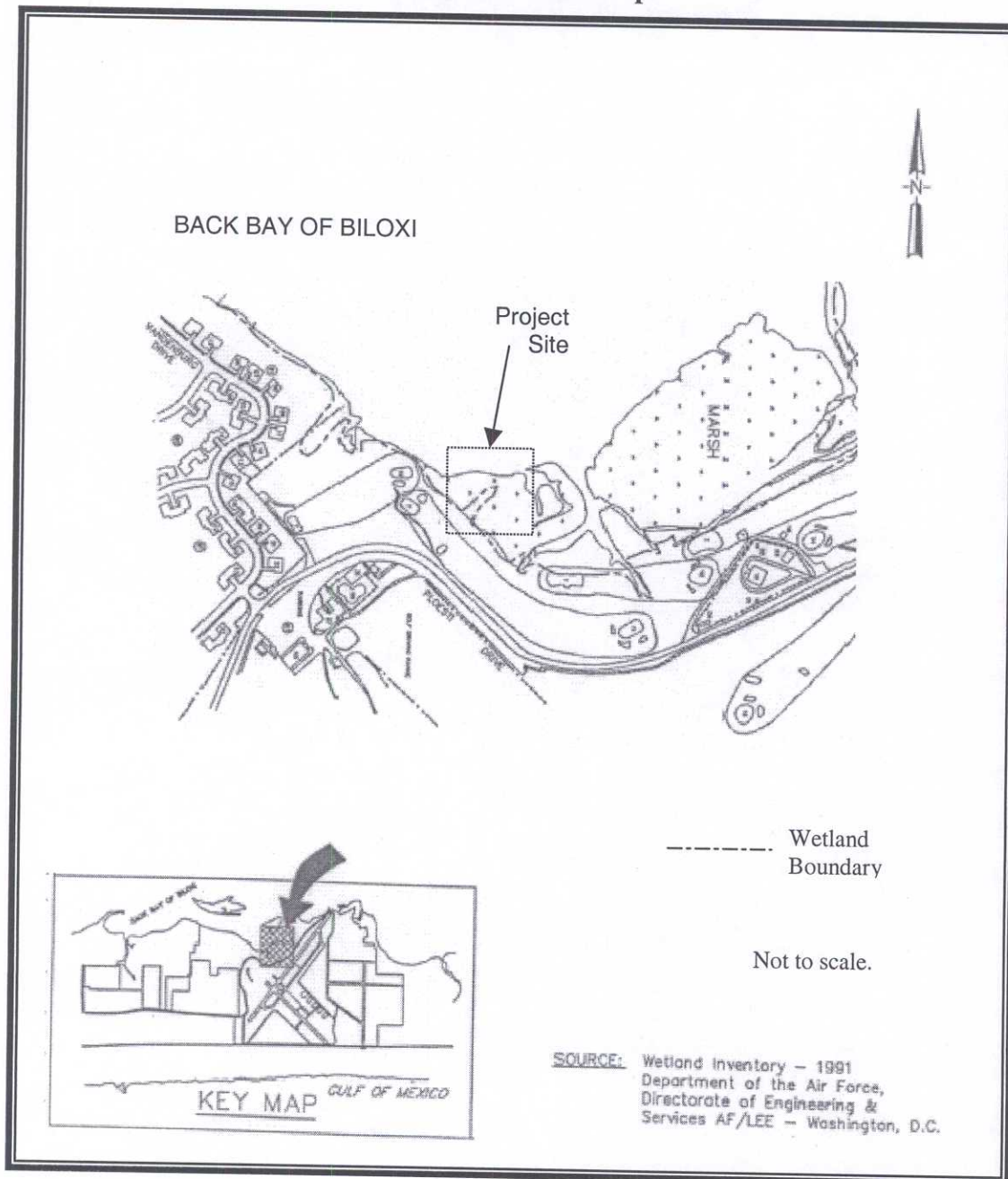
Timing of the replanting and use of on-site plant material was determined by contacting local experts (personal communication -- Moncreiff, UMS; and Shafer, WES, 18 Sep 00) and review of similar wetland restoration efforts in the Gulf region (Crewz, et. al.) and the *National Guidebook for Application of Hydrogeomorphic Assessment to Tidal Fringe Wetlands* (WES, 1998).

FIGURE 1 - Location Map



The contractor and AFCEE Botanist visited the site 12 Oct 2000 and initiated the tasks listed above (remove berm, move soil from berm and form hummocks in deeper areas, dig JUNROE from nearby marsh and plant in hummocks and shallow areas). Sixty-six hummocks were formed and planted with 1-3 clumps (3-10 stems) of JUNROE per hummock (approximately 1320 stems). The balance (1150) of the stems were planted in shallow areas scattered throughout the area. In the small area (Area 2) to the right of the trail, there was approximately 18 clumps (180 stems) of *Juncus* and over 50 stems of *Typha* (cattail) planted.

FIGURE 2 - Site Map



MONITORING

There are a number of approaches to quantify wetland plant communities (Hayes, et.al 2000). The method selected and described below uses the canopy coverage method to determine relative abundance of vegetation less than 1m tall. Other approaches are used to determine the relative abundance of small tress and shrubs less than 2m tall (line intercept) or for mature wetlands with larger trees and shrubs (belt transect). All methods require taxonomic expertise – ability to identify plants down to species level. Three plants were collected and bagged in the field and later identified in the office.

Because the wetland surveyed doesn't have trees or shrubs, the canopy coverage method was used. This method (Daubenmire 1959) uses a series of 0.25-m² quadrants (0.5m x 0.5m) placed along a transect (Figure 3).

Methodology

On 26 Jun 01, the wetland was thoroughly walked with emphasis on the areas replanted October of last year. Sampling began at 0930 hrs during low tide and ended at 1330 hrs while the tide was coming in. Two sites were sampled using a single transect method. A small wetland area (Area 2) to the east of the access road was sampled separately from the large open wetland (Area 1) even though, the larger wetland feed the small wetland and were connected through a six foot wide depression. For the large, open wetland, a single transect line with 0.25-m² quadrants (canopy coverage) was determined to be the best approach for data collection. The transect endpoints were an upland, large *Populus deltoides* (POPDEL) (Eastern cottonwood) to the west of the access road and an *Iva frutescens* (IVAFRU) (marsh elder) on the Back Bay side to the east of the inlet that feeds the restored wetland. This transect is 140 linear feet (') from the mouth of the inlet to the ordinary high water mark (upland edge) bearing 50° (degrees) magnetic from POPDEL. Plots were taken at 15' (approximately 3 meters) intervals along transect, 1 meter (m) from transect and alternated to either side of the transect. Which side of transect the plot was taken dependent on a random numbers table with odd numbers to the right of transect or towards the Back Bay and even numbers to the left or inland side. Plots 10 and 11 were taken at a 90° angle (140° and 320° magnetic, respectively) from the 84' mark (wooden piling) and at 10 paces from transect. Plot size is .25m² (.5m x .5m quadrant).

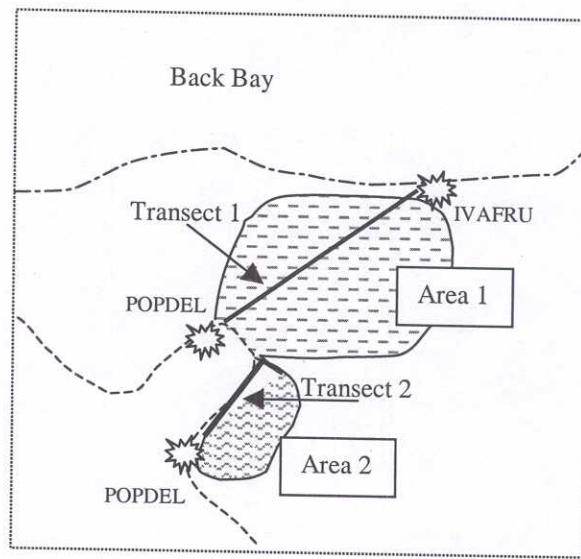
AREA 2 was sampled a little differently due to its small size. One transect was placed at the upland edge of the wetland and the quadrant was tossed out into the wetland at 15' (approximately 3m) intervals along transect. The base of the transect was a POPDEL, different than the one used in AREA 1, and measured 48' to the edge of the depression (outlet to the AREA 1). After this transect was placed, it was determined to be parallel to AREA 1 transect, that is, on a 50° bearing magnetic.

For all quadrants, the canopy cover was estimated by imaging a vertical line from the outermost tips of the plant down to the ground within the quadrant, this included plants rooted outside the quadrant. Bare ground and open water was also estimated.

When water was present, depth was recorded in the same left corner nearest the transect line.

This methodology was determined best for this wetland based on three publications (Crewz, et.al. 1991; Hayes, et.al. 2000; Elzinga, et.al. no date).

FIGURE 3 - Site Map with transects (Area 1 & 2)



Data

Converting the percent cover data collected by the canopy coverage method involves summing the average canopy coverages per species. The total coverage by all species is simply the sum of average coverage of the individual species. Relative abundance of a particular species equals its coverage divided by the total coverage of all species. (Hayes, et.al. 2000)

After relative abundance data was compiled, the dominance-diversity data was plotted (species-specific relative abundances plotted against dominance rank from most to least abundant). Shannon-Weaver Index (H) and Pielou's evenness index (J) are two of the most common computations for determining diversity.

$$H = -\sum p_i \log(p_i)$$

$$J = \frac{H}{\log(S)}$$

where S=total number of species and p_i =relative abundance of species i .

TABLE 2 - SPECIES LIST (TRANSECTS)

AREA 1

PLOT #	LENGTH (')	(O/E)	WATER DEPTH (cm)	% OPEN WATER	% JUNROE	% SPAALT	% RUPMAR	COMMENTS
1	15	O	12	100	0	0	0	Too deep, near outlet to bay
2	30	O	7	95	0	5	20	Soft, muddy bottom; SPAALT signs of spreading; algae (RUPMAR) colonizing
3	45	O	3	50	0	50	0	Old wooden pilings; good growth; no algae
4	60	O	7.5	75	0	25	0	Good growth of SPAALT
5	75	E	6	75	0	25	0	Some colonization of SPAALT; no algae
6	90	E	4	80	25	5	0	No algae (RUPMAR); SPAALT not spreading; JUNROE spreading, good growth, flowered
7	105	E	12	5	90	T	0	Strong JUNROE growth, flowered
8	120	O	0	50	50	0	10	Mucky, reddish orange soil; good algae (RUPMAR); JUNROE spreading, flowered
9	135	O	0	75	2	25	10	Good algae (RUPMAR); SPAALT spreading
10		E	8	50	50	0	25	Good algae cover (RUPMAR); JUNROE spreading
11		O	0	0	70	T	0	Good growth; SPAALT spreading into JUNROE; JUNROE flowered and seed drop.

1. Measure taken from 0' along transect

2. Odd random number = plot taken to outside or Back Bay side; Even random number = plot taken on the inside or inland side.

3. Algae tentatively identified as RUPMAR (Widgeon grass).

AREA 2

PLOT #	LENGTH (')	DISTANCE FROM TRANSECT (')	% BARE SOIL	% JUNROE	% SCIROB	COMMENTS
1	0	3.0	20	0	80	Undisturbed; original edge; dry
2	15	10.0	50	0	30	Broadleaf herb (coll#20010626-2/1) found (T); dry
3	30	6.5	95	0	5	Dry
4	45	10.0	50	5	5	Sedge (coll#20010626-2/2); moist

RESULTS

This restored marsh is a mosaic of smooth cordgrass (SPAALT) and black rush (JUNROE) with the smooth cordgrass in the shallower areas around the perimeter and the black rush in the deeper center. Scattered throughout the marsh, Widgeon grass (RUPMAR) is present. The grass was not planted on the site, one can only assume that it was present in the seed bank of the original marsh or was washed into the marsh from adjacent wetlands. To date there are no other plants present in the restored area.

The wetland was originally planted with 20,000 nursery sets in October 1999 with a supplemental planting of approximately 1,150 sets of black rush collected on-site and planted in Oct 2000. The 2000 planting was deemed necessary after a visual assessment the previous month (Sep 2000) and a determination made that less than 75% of the original plants survived. A variety of conclusions were discussed about the lack of survival -- winter weather/tide action too strong, depth of water at high tide too deep, sets not planted properly, sets not healthy when planted (delay during transport from FL nursery to site), or sets not acclimated to saline level of site. No matter the reason(s) for unsuccessfulness, the unvegetated areas were replanted with black rush (JUNROE) collected on-site.

Even though, there are still open, unvegetated areas, this smooth cordgrass/black rush tidal marsh is healthy and productive. During vegetative sampling, a number of fish, crabs, and birds were observed in the area and no invasive species were found in the restored area. These are indicators of an ecosystem moving to equilibrium.

It is recommended that future samplings follow the above methodology or use the Army Corps of Engineers Tidal Fringe Hydrogeomorphic (HGM)

SCHEDULE

DATE	ACTION/TASK	RECOMMENDATIONS
Jun 01	Year 1 monitoring	Completed
Dec 01	Photo point monitoring	Take mid-year landscape photograph of area as visual record.
Jun 02	Year 2 monitoring	Use tidal fringe HGM is available; if not, repeat this sampling methodology. Consult with Army Corps of Engineers/MS DMR and determine if percent coverage is adequate to meet the needs of the success criteria; replant as needed.
Dec 02	Photo point monitoring	Take mid-year landscape photograph of area as visual record.
Jun 03	Year 3 monitoring	Use tidal fringe HGM is available; if not, repeat this sampling methodology.
Dec 03	Photo point monitoring	Take mid-year landscape photograph of area as visual record.
Jun 04	Year 4 monitoring	Use tidal fringe HGM is available; if not, repeat this sampling methodology. Consult with Army Corps of

		Engineers/MS DMR and determine if percent coverage is adequate to meet the needs of the success criteria; replant as needed.
Dec 04	Photo point monitoring	Take mid-year landscape photograph of area as visual record.
Jun 05	Year 5 monitoring	Use tidal fringe HGM is available; if not, repeat this sampling methodology. Take landscape photograph of restored wetland and submit with final report.

REFERENCES

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- Personal Communication (electronic mail [cynthia.moncreiff@usm.edu]): Moncreiff, Cynthia, Ph.D., USM Institute of Marine Sciences, Gulf Coast Research Laboratory, Ocean Springs, MS. Apr 00 and Sep 00.
- Personal Communication: Shafer, Deborah. Aquatic Biologist, Waterways Experiment Station, Vicksburg MS. 18 Sep 00.
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APPENDIX A FIELD NOTES

26 Jun 01

Keesler AFB

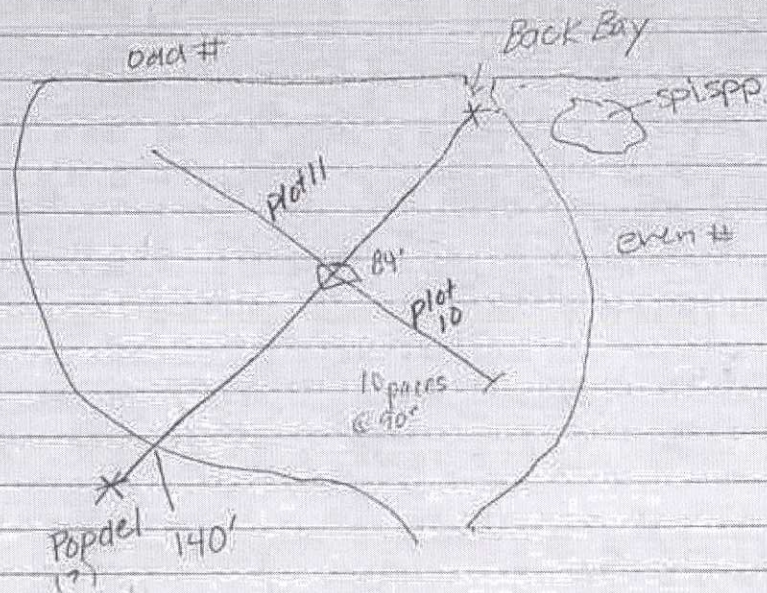
ST 0930hr CST

ET 1330hrs CST

Weather:

clear skies, slight breeze;

humid (); hot (°F)



.5m plots @ 15' intervals (≠ 5m)

bearing 50° magnetic

4

5

Plot #	DIE	%H ₂ O	%Junroe	%spapra	%algae	Comments	
1(15)	0	100	0	0		1. too deep, near outlet to bay	12cm
2(30)	0	95	-	5		2 soft muddy bottom, spapra signs of spread	
3(15)	0	50	-	50		algae colonization 7cm deep	
4(40)	0	75	-	25	-	3 old pilings, good growth no algae	3cm
5(75)	E	75	-	25	-	4 good growth spapra	7.5cm
6(90)	E	80	25	5	-	5 some colonization, no algae	6.0cm
7(105)	E	5	90	T	-	6 no algae, spapra not spreading	4cm
8(120)	0	50	50	-	T	Junroe spreading, good growth, flowered	
9(135)	0	75	-	25	T	7 strong Junroe growth, flowered	12cm
10(145)	0	50	50	-	T	8 mucky, reddish orange soil, good algae, Junroe spread, flowered	0 cm
11(160)	0	75	-	25	T	9 good algae, spapra spreading	0 cm
12(175)	E	50	50	-	T	10 good algae cover, Junroe spreading	8cm
13(190)	E	50	50	-	T	11 good growth, spapra spreading, flowered	0 cm
14(205)	E	50	50	-	T	12 Junroe, Junroe flower & seed	

Algae #20010624-1/1

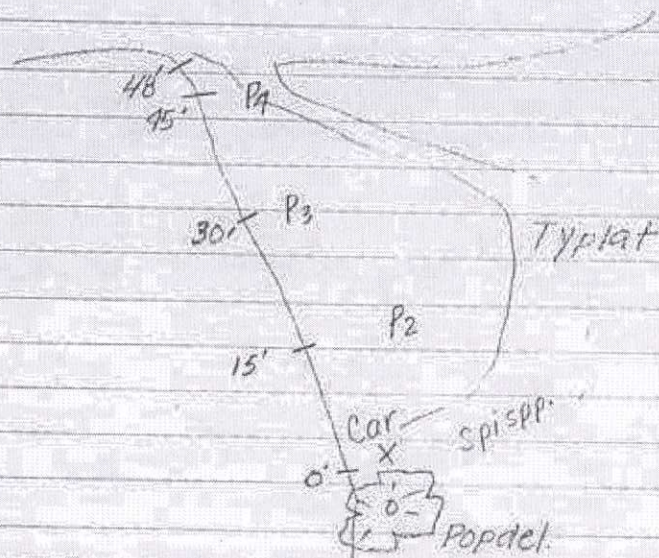
50' m U-48'

plot #	distance m	% bare	no Sprota	Junroe	% CAR spp	% other
1/0	1	20	-	-	80	
2/15	10 ³	50	-	-	30	
3/30	6.5 ²	98	X	-	5	
4/45	3	50	-	5	5	

Natural regen of *Carex* spp.
couple of *Junroe* survived
no *Thyfat* survived
why?
dried out in center

CAR spp Coll # 20010626-2/2

- 1 undisturbed, original edge dry H2O 0
- 2 broadleaf herb coll # (20010626-2/1) (T) 0
woody 25 dry
- 3 dry 0
- 4 sample 20010626-2/1 (5%) 0
moist



YEAR 1 MONITORING DATA (JUNE 2001)

Plot #	% JUNROE	% SPAALT	% RUPMAR	% SCIROB	
1-1	0	0	0	0	
1-2	0	5	20	0	
1-3	0	50	0	0	
1-4	0	25	0	0	
1-5	0	25	0	0	
1-6	25	5	0	0	
1-7	90	2	0	0	
1-8	50	0	10	0	
1-9	2	25	10	0	
1-10	50	0	25	0	
1-11	70	2	0	0	
Sum of % cover	287	139	65	0	491
Average	26.09090	12.636363	5.9090909		
Relative Abundance	0.584521	0.2830957	0.1323828		

Plot #	% JUNROE	% SPAALT	% RUPMAR	% SCIROB	
2-1	0	0	0	80	
2-2	0	0	0	30	
2-3	0	0	0	5	
2-4	5	0	0	5	
Sum of % cover	5	0	0	120	125
Average	1.25			30	
Relative Abundance	0.04			0.96	

Shannon- Weaver Index				
(Area 1) H=	705.4121	297.87905	117.83936	
(Area 2) H=	-			-
	0.055917			0.0170196

Pielou's evenness index				
(Area 1) J=	1478.475	624.32569	246.97991	
(Area 2) J=	-			-
	0.185754			0.0565379

APPENDIX B PHOTOGRAPHIC DOCUMENTATION

**SITE AFTER REMOVAL OF UPLAND VEGETATION
AND LANDFILL MATERIAL**

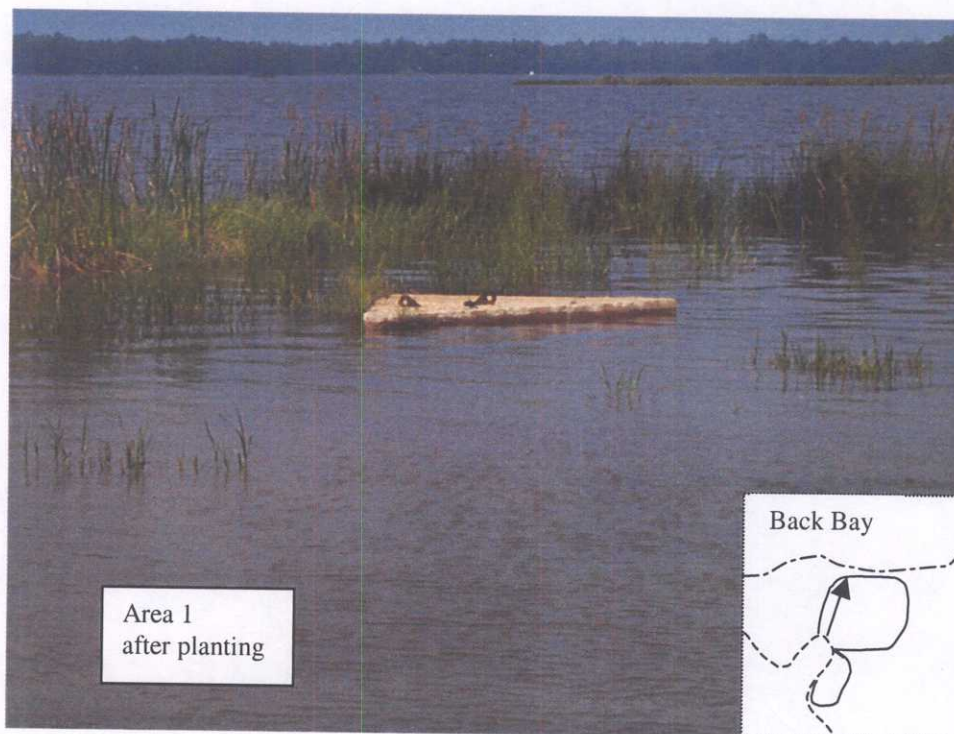


PLANTING OF SITE (DATE 1999)



JUNROE
planting stock

Field crew-
planting material

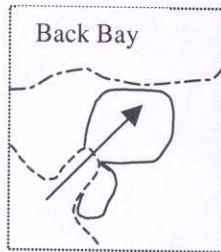


Area 1
after planting

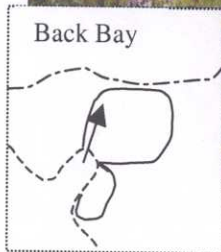
Back Bay

SITE VISIT -- SEP 2000

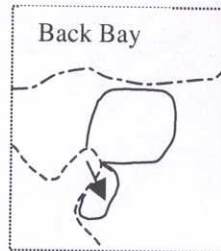
Overview of area from edge of
golf course.



West side
of wetland



Area 2, mostly TYPLAT

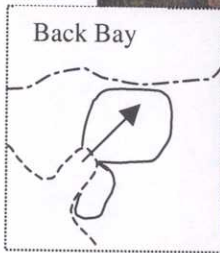


REPLANTING SITE -- OCT 2000

Center view after
replanting site.



Back Bay

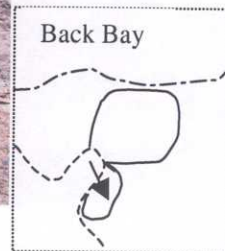


Hummocks --
scattered throughout
and with multistems.



Area 2 -- After removal
of 1-2' of soil and berm;
replanted displaced
TYPLAT.

Back Bay

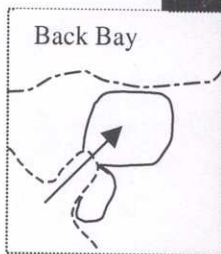


MONITORING YR1 SITE VISIT -- JUN 2001

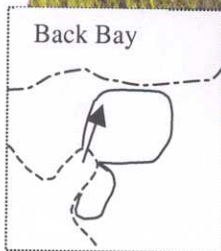
Overview of area from edge of
golf course.



Back Bay



Back Bay



Area 1 - west side

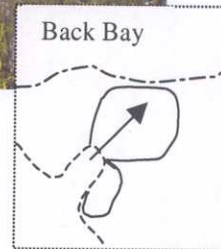


Area 1 - center



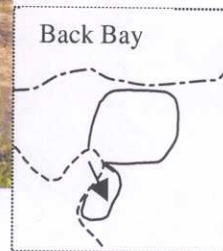
Hummocks -- surviving
after 6 months.

Back Bay

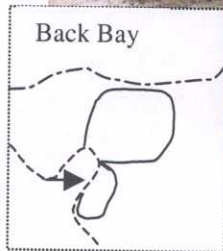




Area 2 - site dominated
by SCIROB



Area 2 - Transect
along upland edge.



0.25m^2 (0.5 x 0.5m)
Quadrant



LANDSCAPE COMPARISONS

SEPTEMBER 2000 SITE VISIT



JUNE 2001 SITE VISIT

